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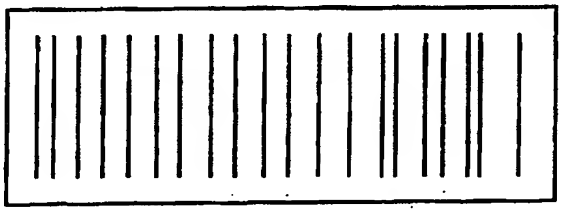
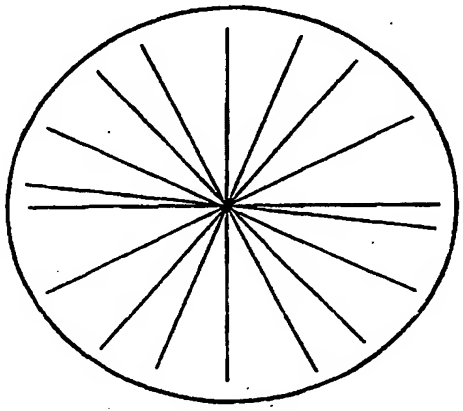
(54) Title: MAGNETIC TAGS

(57) Abstract

A magnetic tag is disclosed, the tag comprising a plurality of magnetically active elements supported on or by a substrate, the magnetically active elements displaying or being capable of displaying magnetic anisotropy. The tag is characterised in that the magnetically active elements are generally linear and have an axis of easy magnetisation along their length, and in that said elements are disposed so as to transect one another. In another embodiment, the tag is generally rectangular, having a major axis and a minor axis; a plurality of magnetically active elements are supported on or by a substrate, the magnetically active elements displaying or being capable of displaying magnetic anisotropy. The magnetically active elements are generally linear and have an axis of easy magnetisation along their length, and are disposed so as to transect the major axis of the tag.





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MAGNETIC TAGS

In previous patent applications, in particular PCT/GB96/00823 (WO96/31790) and PCT/GB96/00367 (WO97/04338), we have described and claimed novel techniques for spatial magnetic interrogation and novel magnetic tags. The technology described in WO96/31790 is based on exploiting the behaviour of magnetic materials as they pass through a region of space containing a magnetic null. In particular, these earlier applications describe, inter alia, how passive tags containing one or more magnetic elements can perform as remotely-readable data carriers, the number and spatial arrangement of the elements representing information.

In the above applications we described a number of possible system embodiments employing either permanent magnets or electromagnets to create the magnetic null. We also described several system implementations some of which are particularly appropriate for tags employing very low coercivity, high permeability magnetic elements. These implementations work by detecting harmonics of a superimposed low-amplitude alternating interrogation field.

In a later application, GB9612831.9 (and its counterpart PCT/GB97/01662), we described arrangements which work by detecting the baseband signals generated by the passage of the tag through the magnetic null, without the need for any superimposed alternating interrogation field. A specific design for a reader in the form of a narrow slot is also described.

The present application relates to certain types of magnetic tag which are expected to find use in

detection/interrogation systems of the type described in the earlier patent applications mentioned above, but also in other systems.

According to one aspect of the present invention, there is provided a generally rectangular magnetic tag having a major axis and a minor axis, which tag comprises a plurality of magnetically active elements supported on or by a substrate, the magnetically active elements displaying or being capable of displaying magnetic anisotropy, characterised in that the magnetically active elements are generally linear and have an axis of easy magnetisation along their length, and in that said elements are disposed so as to transect the major axis of the tag. Generally (but not necessarily) the magnetic elements will be disposed parallel to the minor axis of the tag.

A tag of this form can be read using a quadrupole magnetic field. For example, satisfactory results have been obtained using an interrogation system of the sort described in PCT/GB96/00823 (published as WO 96/31790), with a 2D quadrupole field gradient of 2kA/m/m, an AC drive of 30 A/m rms at 6.25kHz, using second harmonic detection at 12.5kHz; the tags included a plurality of magnetic elements formed from Vacuumschmeltze's 6025 spin melt ribbon, each element having dimensions (in millimetres) of 32 x 0.8 x 0.025. The tag is moved through the interrogating field in the direction of its major axis. For best operation, the plane of the tag should be located within 30° of the quadrupole axis.

An advantage of this type of tag construction is that greater density of data can be carried on a given tag size.

According to another aspect of the present invention, there is provided a magnetic tag which comprises a plurality of magnetically active elements supported on or by a substrate, the magnetically active elements displaying or being capable of displaying magnetic anisotropy, characterised in that the magnetically active elements are generally linear and have an axis of easy magnetisation along their length, and in that said elements are disposed so as to transect one another.

In one embodiment, the tag is generally circular; in this case, the magnetic elements, or at least some of them, intersect one another at the centre of the circle. In one particular embodiment, all of the magnetic elements are disposed as diameters of the circle. In another embodiment, the tag is in the form of a sphere or a spheroid and the magnetic elements are disposed as diameters of the sphere or spheroid.

Using the "circular" embodiment just described, the interrogation system uses a rotating scanned field of fixed magnitude 300 A/m, rotating at 16.66 Hz. The magnetic strips have dimensions (in millimetres) of 32 x 0.8 x 0.025 and are radially spaced by at least 6°. The interrogation system can be the same as that described above in relation to the first aspect of the invention.

Spherical arrays, where the magnetic elements are disposed as diameters of a sphere, are preferably such that the average strip spacing subtends an angle of about 9° at the notional centre of the sphere. Such a tag can have, for example, 252 magnetic strips.

Examples of tags of the invention are given in the

accompanying drawing, where Fig. 1 shows a tag of the first (rectangular) kind and Fig. 2 shows a tag of the second ("petal") kind.

The invention is not restricted to the embodiments described above, which are given as non-limiting examples.

CLAIMS:

1. A magnetic tag which comprises a plurality of magnetically active elements supported on or by a substrate, the magnetically active elements displaying or being capable of displaying magnetic anisotropy, characterised in that the magnetically active elements are generally linear and have an axis of easy magnetisation along their length, and in that said elements are disposed so as to transect one another.

2. A tag as claimed in claim 1, characterised in that said tag is generally circular in form.

3. A tag as claimed in claim 2, characterised in that said magnetically active elements or at least some of them intersect one another at the centre of the circle.

4. A tag as claimed in claim 1, characterised in that said tag is in the form of a sphere or a spheroid and the magnetic elements are disposed as diameters of the sphere or spheroid.

5. A generally rectangular magnetic tag having a major axis and a minor axis, which tag comprises a plurality of magnetically active elements supported on or by a substrate, the magnetically active elements displaying or being capable of displaying magnetic anisotropy, characterised in that the magnetically active elements are generally linear and have an axis of easy magnetisation along their length, and in that said elements are disposed so as to transect the major axis of the tag.

6. A tag as claimed in claim 1, characterised in

that said magnetically active elements are disposed parallel to the minor axis of the tag.

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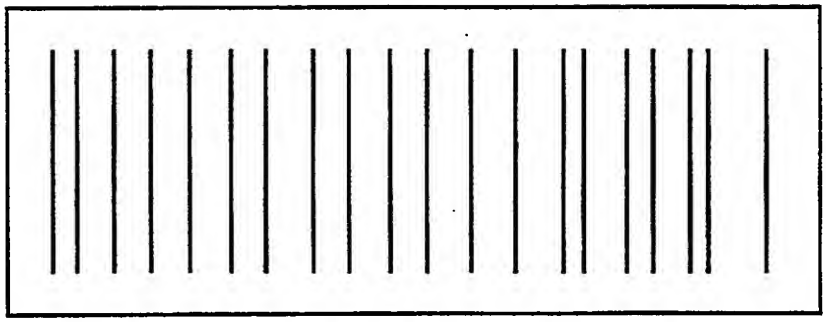

Fig. 1

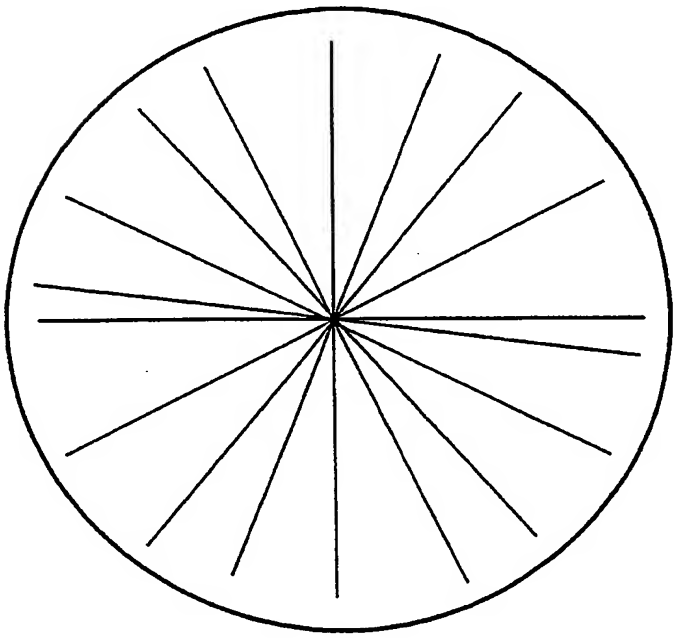

Fig. 2

INTERNATIONAL SEARCH REPORT

Inter ...nal Application No
PCT/GB 97/03389

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G01V15/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G01V G08B E05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 017 907 A (CORDERY ROBERT A ET AL) 21 May 1991	5,6
A	see abstract see figures 4,5 see claims 1,2	1
X,P	GB 2 312 595 A (FLYING NULL LTD) 29 October 1997 see abstract see figure 1 see page 6, line 10 - page 7, line 23 see claims 1,3,5,8,17	5,6

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
14 April 1998	21/04/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	de Heering, Ph.

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INTERNATIONAL SEARCH REPORT

Inter onal Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 295 085 A (SCIENT GENERICS LTD) 14 December 1988 see abstract see page 1, line 5 - page 1, column 20 see claims 1,7 see figures 3,4	5,6
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